

Incident Report: 12/08/04 **Goodrich Open Burn Monitoring**

Scenario: The Arizona Department of Environmental Quality (ADEQ) Hazardous Air Response Team (HART) was requested to monitor a planned open burn of propellants and devices that could not be shipped from the Goodrich UPCO facility. Planning for the monitoring exercise began in late November 2004. Under the consent order with UPCO, ADEQ approved the burn subject to the condition that meteorological conditions would transport the plume from the open burn away from residences in the area. Historically, Goodrich had performed burns with approximately 300 pounds of propellant and devices. However, ADEQ's approval was limited to 50 pounds of materials, but only approximately 25 pounds of materials were ultimately burned. Previous air quality modeling indicated that no significant ground level concentrations should occur as a result of the burn.

Monitoring Strategy: The HART monitoring strategy relied upon the use of the HART monitoring van as a meteorological / air quality monitoring base station supplemented by portable air quality monitoring equipment at three additional locations on the northern and eastern boundary of the property. HART personnel met with UPCO personnel to review the monitoring strategy and arrange for access to the eastern perimeter fence line. An aerial photo of the area indicating the monitoring locations and location of the burn pad used to dispose of the materials is shown below in Figure 1.



Figure 1. Monitoring and Open Burn Locations

The permit restricted the burn to periods when meteorological conditions would transport emissions away from the roadway to the south, and residents to the north. Specifically, surface winds would have to be from the southwest to west in order for the burn to be initiated. This would carry emissions to the north east to east. Monitoring locations were selected based on the following rationale: The HART monitoring van and one set of portable monitors would be located at location #4 on the aerial photo at the location of the nearest residence. This elevated location also gave a good vantage point to observe the surrounding area. Two sets of portable monitors would be located along the eastern fence line of the Goodrich property in the direction where the plume was expected to be transported (locations #1 and #2). Finally, a fourth set of portable monitors would be located to the west of the monitoring van along Yearling Road that would provide background concentrations if the plume transport was to the northeast to east, and exposure estimates in case there was a sudden wind shift and the plume from the burn were transported north into the residential area.

Meteorological monitoring data available on the HART monitoring van included wind direction, wind speed, temperature and relative humidity from the data logger on the van that recorded 5-minute average parameters. In addition to the meteorological equipment on the HART monitoring van, Goodrich personnel used a portable meteorological station located in the burn pad area to provide a display of instantaneous wind speed and wind direction prior to the ignition of the burn.

ADEQ deployed three types of samplers to measure particulate matter smaller than 10 microns (PM_{10}) in the air. The first of these was the TEOM PM_{10} analyzer on the HART monitoring van at monitoring location #4. The TEOM analyzer provides 5-minute average measurements of PM_{10} in the atmosphere. To augment this analyzer, a DUSTTRAK analyzer, routinely used by HART for monitoring smoke from fires, was positioned at each of the four monitoring locations. The DUSTTRAK analyzer uses optical measurement techniques to provide 5-minute average concentration estimates of particulate matter in the atmosphere.

The quantity of material to be consumed in the burn was significantly smaller than previous burns conducted by Goodrich. As such, emissions were expected to be relatively low, and ambient concentrations were expected to be correspondingly low according to previous air

quality modeling studies. For monitoring the burn, the TEOM and DUSTTRAK analyzers would provide confirmation that concentrations were well below the levels that would be unhealthy. However, there is always a possibility that dispersion characteristics could deviate from those planned and elevated concentrations could possibly occur. Since the TEOM and DUSTTRAK analyzers do not provide a filter that can be analyzed for composition of particulate matter, mini-vol portable air samplers were also positioned at each of the four monitoring locations. The mini-vol sampler uses a filter, like the ones used for standard PM₁₀ sampling, which could be used to determine composition of PM₁₀ in the atmosphere if a significant concentration of PM₁₀ were to be measured during the burn. In the unlikely event elevated concentrations were to occur, the filters could be used to estimate the concentration of hazardous air pollutants (HAPS).

Pre-Burn Preparation and Monitoring: The mini-vol samplers were checked out, batteries charged, and filters prepared. The samplers were operated and cycled to ensure the batteries would support the monitoring campaign. The DUSTTRAK analyzers were also checked out and batteries charged. The equipment on the HART monitoring van was checked out to ensure the TEOM analyzer, meteorological equipment and data logger were functioning correctly.

ADEQ meteorologists monitored meteorological forecasts for the Deer Valley Airport location just south of the Goodrich facility to identify days when prevailing meteorology would be consistent with the conditions of the permit. Interpretations of these forecasts were communicated to the ADEQ Air Quality Division Compliance Section staff and Goodrich personnel on a daily basis. A series of weather systems came through the area producing winds that would not allow the burn. On December 1, 2004, the forecast indicated that after a system passed through the following week that winds could be consistent with the conditions of the permit. This situation was monitored throughout the week with the forecast continuing to indicate that the afternoon of December 8, 2004, would be consistent with the conditions established by ADEQ. On the afternoon of December 7, 2004, the forecast was checked and confirmed that the following day would be a candidate for the open burn.

On the morning of December 8, 2004, the updated forecast was examined. Winds were expected to be out of the northeast in the early morning shifting to out of the east by mid-morning. As the day progressed, winds were expected to gradually turn from out of the east to out of the south by about noon. After noon, winds were

expected to shift from out of the south to out of the southwest by mid-afternoon, and then continue to rotate until they were out of the west by early evening. Goodrich personnel were contacted to obtain current meteorological information at the facility. The wind conditions were consistent with the forecast. The decision was made to mobilize the HART monitoring van and personnel and prepare for monitoring if meteorological conditions continued to change as expected from the forecast.

HART Monitor Deployment: HART personnel departed the ADEQ offices at 9:43am on December 8, 2004. HART personnel included the HART Manager Shawn Kendall and HART Responders Randy Redman, and Dan Catlin. The HART monitoring van arrived at monitoring location #4 at approximately 10:00am. The TEOM analyzer, data logger and computer were turned on and the wind monitoring equipment was deployed and aligned by 10:35am. A DUSTTRAK analyzer and mini-vol sampler were positioned on the roof of the monitoring van. A photograph taken later in the day is included as Figure 2 showing the view of the top of the monitoring van with the Goodrich facility and downtown Phoenix in the background. The winds at the monitoring van were consistent with earlier observations and beginning to shift



Figure 2. HART monitoring van at monitoring location #4 (looking south)

to flow from the south as expected. The results from the morning aircraft soundings from Sky Harbor International Airport indicated a split flow with upper level flows from the southwest above the surface flow from the southeast. It was expected that the flow from the southwest would penetrate to the surface once the surface inversion burned off later in the afternoon. Goodrich personnel were notified that the HART monitoring van was in position and operational and conditions still looked favorable for a burn in the afternoon.

HART personnel proceeded to the Goodrich facility at 10:55am. After introductions they received the standard OSHA safety briefing for operations within the plant area so they could visit the burn pad and perimeter fence where monitoring was planned. HART personnel arrived at the burn pad at 11:40am. The handheld GPS indicated the coordinate of the center of the northeast side of the burn pad was N 33 Deg 27' 02.4", W 112 Deg 05' 10.8". The heavy steel burn barrel was approximately 4 feet tall and 2.5 feet in diameter and was located at the southwest end of the burn pad.

A DUSTTRAK analyzer and mini-vol sampler were deployed at monitoring locations #2 at 12:30pm. Collection of 5-minute average PM₁₀ concentrations began at 12:30pm. Figure 3 is a view to the north showing the mini-vol sampler mounted on the perimeter fence, with the hills in the background to the north.



Figure 3. Mini-vol sampler at monitoring location #2 (looking north)

The HART responders proceeded to monitoring location #1 and set up a DUSTTRAK analyzer and mini-vol sampler at a location to the south of monitoring location #2. Collection of 5-minute average PM₁₀ concentrations began at 12:35pm. Figure 4 shows the mini-vol sampler



Figure 4. Mini-vol sampler at monitoring location #1 (looking northwest)

mounted on the perimeter fence at location #1 (HART responders Dan Catlin and Randy Redman are shown checking field notes on the right).

The HART responders left the Goodrich facility and proceeded to the north perimeter of the property along

Yearling Road. Monitoring location #3 was established approximately 0.2 miles east of Central Avenue on the Goodrich's north property boundary along Yearling Road. A DUSTTRAK analyzer and a mini-vol sampler were set up at this location. Collection of 5-minute average PM₁₀ concentrations began at approximately 12:55pm. A photograph of the mini-vol sampler and DUSTTRAK analyzer deployed at monitoring location #3 is shown in Figure 5.



Figure 5. Mini-vol sampler & DUSTTRAK at monitoring location #3 (looking west)

The HART responders then returned to the HART monitoring van at monitoring location #4. They performed a final flow check and turned on the pump for the mini-vol sampler that had been previously set up on the roof of the monitoring van.

Pre-Ignition Meteorological Monitoring:

HART personnel remained onsite and continued to monitor evolution of the expected change in wind direction to flow from the southwest. During this period, the ADEQ staff meteorologist supporting the HART team was consulted on a routine basis to augment on-site meteorological information being acquired by ADEQ at monitoring location #4 and Goodrich at the burn pad. At approximately 1:00pm wind flow from the southwest was first observed at the HART monitoring van. Winds at the monitoring van shifted to flow from the south at approximately 1:20pm although winds continued to be from the southwest at the burn pad. Preparations were made to move the material to be burned from the magazine storage area to the burn pad. The burn barrel was being charged when the winds again shifted to out of the southwest at the monitoring van and remained fairly steady. HART personnel conferred with Goodrich personnel and confirmed that meteorological conditions were consistent with the objective to transport smoke into the area east of the facility.

Open Burn Monitoring: Final ignition sequence preparations began at approximately 2:45pm. Actual ignition of the burn barrel occurred a few minutes later with a large puff of smoke from the propellant scrap that quickly dissipated (see Figures 6 and 7 taken of the burn pad area from the HART monitoring van at location #4). Winds dropped to near calm conditions at the exact time of ignition, and continued from the southwest on the surface. The initial puff from the burn barrel rose significantly and was caught in the easterly flow above the surface layer flow from the southwest. The wooden stakes and duff material ignited and continued to burn for approximately thirty minutes with occasional popping of cartridges and devices occurring that disposed of the remaining materials.



Figure 6. Initial Plume



Figure 7. 30 Seconds Later

Five-minute average wind speed and direction was stored throughout the pre-ignition and open burn monitoring period and is shown in Figure 8. Winds transitioned from the southeast to the southwest as expected and stabilized

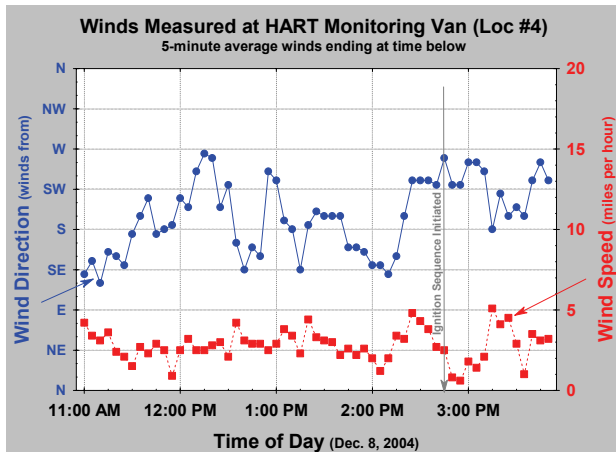


Figure 8. HART Monitoring Van Winds From 11:00am to 4:00pm on Dec. 8, 2004 (5-min avg)

at approximately 2:25pm. Surface flow at the HART monitoring van shifted to the south-southwest at approximately 3:15pm for 25 minutes and then continued from the southwest.

Data collected from 11:00am to 4:00pm is presented in Figure 9. At 1:00pm the winds shifted from the southwest and all PM_{10} concentrations dropped due to a shift in the background concentration from the southwest.

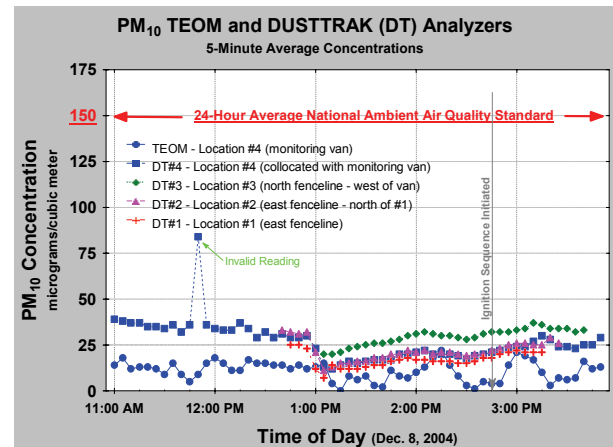


Figure 9. PM_{10} Monitoring Data Collected 11:00am to 4:00pm on Dec. 8, 2004 (5-min avg)

All DUSTTRAK monitor measurements tracked well with one another. All concentrations were well below the 24-hour average National Ambient Air Quality Standard (NAAQS). The variation of concentrations measured by the TEOM analyzer after ignition of the burn were identical to the variations measured an hour prior to the burn. Samples from the mini-vol samplers were below detection limits.

Conclusion: The open burn was conducted in accordance with the conditions provided by ADEQ. Winds developed from the southwest in the surface layer as expected. Monitoring of meteorological conditions confirmed that pre-ignition conditions met the criteria approved by ADEQ.

No significant ground level concentrations occurred as a result of the burn. This was evident from monitoring at the four locations with DUSTTRAK analyzers, and the TEOM monitor on the HART monitoring van. This finding confirms previous modeling studies that indicated no significant concentrations would be expected for an open burn of this magnitude.